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Chapter 2

ARCHAEOLOGICAL CONTEXT

by
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Between 1982 and 1986, winter precipitation in the northern Great Basin hit record levels, resulting in severe flooding in the Carson Desert. As the waters receded, erosion in about 80 sq. km of the Stillwater Marsh exposed hundreds of prehistoric burials, caches, trash pits, and houses that contain a wealth of well preserved faunal, floral, artifactual, and human remains. The following brief review of the archaeology of the Carson Desert and vicinity demonstrates the importance of these sites for understanding the prehistory of the western Great Basin, as well as their utility in informing us about larger issues of hunter-gatherer cultural ecology. Cultural resource overviews of the Carson Desert have been prepared by Bard, Busby, and Findlay (1981), and Pendleton, McLane, and Thomas (1982).

Aboriginal life in the western Great Basin is imperfectly understood. While numerous caves and rockshelters at Pyramid, Winnemucca, and Carson Lakes have been excavated, few have been reported thoroughly. Moreover, those investigations took place some years ago, in the absence of techniques suitable to address today's research problems; also, many sites had been badly disturbed by looters and guano miners long before archaeologists studied them. The ethnographic baseline for the western Great Basin also is sparse, as little work has been published for the region. Still, available ethnographic and archaeological data indicate that lacustrine and marsh resources figured prominently in the economy of sedentary and semi-sedentary hunter-gatherer societies in the Great Basin (Madsen 1979, 1982; Janetski 1986; Wheat 1967; Fowler 1982; Fowler and Bath 1981). As discussed below, archaeological evidence suggests that aboriginal lifeways shifted toward a system of reduced residential mobility (increased sedentism) after about 1500 B.P. Thus, the well-preserved archaeology of Stillwater Marsh has the potential to assist a reconstruction of western Great Basin prehistory and contribute to understanding the sedentization process.

Physical Setting

The Carson Desert (Figure 1) is a wide, flat valley of sand dunes, alkali flats, and slightly alkaline marshes located in west-central Nevada, about 100 kilometers east of

Reno and 25 kms northeast of Fallon. At 1180 meters a.s.l., the Carson Desert, one of the lowest points in the west-central Great Basin, forms the sink of the Carson River and, occasionally, the Humboldt River. The Carson Desert formerly contained two large lakes and an extensive marsh. Except in recent years, the lakes no longer exist, although the marsh is maintained by the U.S. Fish and Wildlife Service. The northern sink is covered by an extensive alkaline plain and the southern sink by unstabilized sand dunes, partially vegetated with greasewood (Sarcobatus baileyi), saltbrush (Atriplex confertifolia), budsage (Artemesia spinescens), shadscale (Atriplex canescens), and other halophytes (Billings 1945). The marshes support cattail (Typha angustifolia), bulrush (Scirpus acutus and S. robustus), sago pondweed (Potamogeton pectinatus), and various submergents and salt grasses. Water control projects have stabilized the marsh, resulting in an increase in cattail at the expense of bulrush (Kelly 1985:27-28). The marshes seasonally support more than 160 species of waterbirds, as well as a variety of aquatic mammals. Prehistorically, the Carson Desert was home to three fish species: the tui chub (Gila [Siphateles] bicolor obesus), which was the most important in the aboriginal diet, the Tahoe sucker (Catostomus tahoensis), and the Lahontan redside (Richardsonius egregius) (Smith 1985).

Nearly 70% of the local precipitation falls between December and May, averaging about 123 mm per year. The average annual temperature is about 11 degrees C, with monthly averages ranging from -1 in January to 22 degrees in July; the growing season lasts about 125 days (Kelly 1985:24).

The Carson Desert is surrounded by several mountain ranges; its eastern edge is formed by the Stillwater Range of which the highest peak stands at 2660 m (8785 ft.) a.s.l. Pinyon (Pinus monophylla) and juniper (Juniperus osteosperma) are found only in the more well-watered northern half of the range. There are many small springs and seeps in the range, but no permanent streams. Mule deer (Odocoileus hemionus) and bighorn sheep (Ovis canadensis nelsoni) live in the Stillwaters; the latter were transplanted recently, although records indicate they were present in the early historic period (Kelly 1985:29). Antelope (Antilocapra americana) do not live in the region today, although they probably did in the past.

Previous Archaeological Research

Archaeological research in the region began with the excavation of Lovelock Cave (Figure 3), located north of the Carson Desert in the Humboldt Sink (Loud and Harrington 1929).

While much of the site had been destroyed by guano miners, a plethora of perishable material remains was recovered, including baskets, fishing and waterfowling nets, fishhooks, duck decoys (recently dated to ca. 2160 B.P. [Tuohy and Napton 1986]), and several human burials. Loud and Harrington also commented on the abundance of stone tools on the floor of the Humboldt and Carson Sinks.

In 1936 and 1937, R.F. Heizer excavated Humboldt Cave (Heizer and Krieger 1956), also overlooking the Humboldt Sink and directed an informal survey of the Carson and Humboldt Sinks (Heizer 1956). Granite Point Shelter was partially excavated (Roust 1966) and the Humboldt Lakebed Site (26Ch15) was collected. Leonard Rockshelter, occupied for nearly 7000 years, was excavated by Heizer in 1937 and again in 1949 (Heizer 1938, 1951). More recently, pollen data from this site have been studied by Byrne, Busby, and Heizer (1979).

S.M. Wheeler conducted archaeological research in 1939 for the Nevada State Parks Commission at a few of the 26 caves (including Hidden Cave) near Grime's Point in the southern Carson Sink. While many of the cave sites already had been looted, Wheeler found and reported on burials from one (Wheeler and Wheeler 1969).

In the 1950s, Hidden Cave was re-excavated by the University of California, Berkeley (Roust and Grosscup 1952); Granite Point Cave and Cache Cave (Baumhoff 1958) in the Humboldt Sink also were excavated. Several surface sites in the Humboldt Sink were collected (Elsasser 1958). Roger Morrison (1964) conducted geological work at Hidden Cave, part of his effort to reconstruct the late Quaternary history of Lake Lahontan. Grosscup (1956) conducted an informal survey of the southern Carson Sink, making small collections from a few surface sites. His work indicated the magnitude of the surface archaeology of the Carson Sink. Following these investigations, several cultural chronologies were produced (Heizer 1956; Grosscup 1960) which attempted to correlate sequences from Lovelock Cave, Leonard Rockshelter, and Hidden Cave with the existing scheme of climatic change (Antevs 1948).

In the 1960s, research focused on the Humboldt Sink, where several surface sites, including a number of pit features, were collected and partially excavated (Cowan and Clewlow 1968; Heizer and Clewlow 1968; Stanley, Page, and Shutler 1970). Field notes from the largest of these sites, 26Ch15, a site similar to those in the Stillwater Marsh, only now are being prepared for publication, although many of the artifacts apparently have been lost (Livingston 1986, 1988). Heizer conducted new excavations at Lovelock Cave in the 1960s

Figure 3. Principal archaeological sites near Stillwater Marsh.

1. Hidden Cave
2. Grimes Point
3. Lovelock Cave
4. Humboldt Cave
5. Leonard Rockshelter
6. Humboldt Lakebed Site (26Ch15)
7. Cocanour Site
8. Granite Point
9. 26Pe67

Map Location
Fallon
Humboldt Lake
Humboldt Sink
Humboldt River
ALKALI FLAT
WEST HUMBOLDT RANGE
TRINITY RANGE
HOT SPRINGS MTS
CARSON SINK
SAND DUNES
Stillwater Marsh
Stillwater
Carson River
Indian Lakes
Fallon
LAHONTAN VALLEY
LAHONTAN MTS
SALT WELLS BASIN
Carson Lake
COCOON MTS
STILLWATER RANGE
DESERT MOUNTAINS
N
10 Miles
10 Kilometers
Contour Interval 1000 Feet

(Heizer and Napton 1970; Napton 1969) that resulted in analyses of human coprolites from this and other cave sites (Cowan 1967; Ambro 1967; Roust 1967; Follett 1967; Heizer 1969). These analyses provided the basis for Heizer's concept of 'limnosedentism', a lifeway based on sedentary or semi-sedentary occupation of lakeshores with primary exploitation of marsh and lake resources. In this case, sedentism was reconstructed largely from evidence of marsh resource use (e.g., stored gear such as decoys, coprolite contents, fish caches, etc.) and several assumptions about the productivity and settlement potential of marshes, rather than from an archaeological demonstration of year-round use of the Humboldt Sink (cf. Janetski 1986).

After the Lovelock excavations, research focused on the caves of the Grimes Point region. Tuohy (1969) excavated Hanging Rock Shelter, reporting on the basketry, stone tools, and painted wooden effigy found there. In 1971, Napton (1971) excavated six caves in the Grimes Point area, all of which had been badly disturbed by looters. He collected material from two nearby surface sites, but found no midden at either. Nissen (1982) compiled and analyzed data on six rock art sites in the Grimes Point region. Eetza Cave and Burnt Cave in the mountains south of the Carson Desert were tested in 1975 and 1976 (Busby, Kobori, and Nissen 1975; Busby 1976), to reveal shallow and disturbed deposits. Busby (1976) also recorded an alignment of 25 cairns in the nearby White Throne Mountains, possibly a hunting feature. Numerous small cultural resource management surveys have been undertaken in the region in the last few years (e.g., Botti 1977; Hattori and McLane 1980; York 1976; Jerrums and Rusco 1976).

In 1979 and 1980, Hidden Cave was re-excavated by D.H. Thomas (1985). Combining data from earlier field notes and excavated remains in his report, Thomas suggested that the shelter had been used most intensively about 3700 B.P., primarily to cache gear (principally hunting equipment) and perhaps some food, and secondarily as a logistic outpost, where hunting or plant collecting parties sought temporary relief from the heat of the day.

In 1980 and 1981, Kelly (1985), in conjunction with the Hidden Cave Project, conducted a systematic regional survey of the Carson Desert and Stillwater Mountains. About 7% of the valley, 5% of the northern Stillwater Mountains, and 1% of the southern Stillwater Mountains was examined. Kelly discovered that while there is a plethora of archaeological material on the valley floor, analysis of this material is made difficult by the fact that the exposed valley sites have been looted for decades (Kelly 1983a) and are heavily deflated. [Editor's note: The difficulty of analysis led Kelly originally to conclude that "there is no evidence of sedentism, semi-sedentism or focal use of the Carson Desert" (1985:293).]

Finally, during the summer of 1986, five rockshelters in the Stillwater Mountains were tested by Kelly and surface reconnaissance was conducted at a complex of rock art and hunting blinds on Table Mountain. Most of the rockshelters are small, although three contain deposits more than a meter deep; chronological indicators recovered so far signal post-1500 B.P. occupations, but earlier occupations may lie deeper. Several of these sites contain dry deposits, at least one has excellent stratigraphy, and all contain well-preserved faunal assemblages (including fish remains, possibly from the Carson Desert).

Prehistory in Regional Context

The prehistory of the Carson Desert and the western Great Basin is discussed here in terms of Kelly's 1980-81 survey results (Kelly 1985). Prehistoric peoples utilized regions far larger than are encompassed by most land managing agencies. Therefore, the significance of the archaeology of the Carson Desert becomes meaningful only when viewed in light of the prehistory of the larger region. The following discussion utilizes the chronology established by Thomas (1981) for the central and western Great Basin, and used in the analysis of Hidden Cave (Table 1). [Editor's note: alternate chronological schemes and phase names are discussed in Chapters 3 and 26].

Table 1. Chronological Framework.

Phase	Temporal Period	Projectile Point Types
Yankee Blade	650 - 100 B.P.	Desert Side-notched Cottonwood Triangular Cottonwood Leaf-shaped
Underdown	1450 - 650 B.P.	Rosegate
Reveille	2950 - 1450 B.P.	Elko Corner-notched Elko Eared
Devil's Gate	4950 - 2950 B.P.	Gatecliff Contracting Stem Gatecliff Split Stem

Devil's Gate Phase (4950 - 2950 B.P.)

Analysis of the 1980-81 survey collection showed evidence of more frequent use of the Carson Desert by small task-specific logistical parties than by entire residential groups, during the Devil's Gate Phase. This is supported by Thomas's (1985:374) interpretation of the Devil's Gate Phase use of Hidden Cave as a multifunctional node for storage and an extremely limited logistic outpost. The Carson Desert may have been used primarily for hunting at this time, as caches in Hidden Cave contained more hunting than other kinds of gear. Cattail pollen in Hidden Cave coprolites suggests midsummer use of the Carson Sink; however, sedge seeds and some fish remains suggest early fall use. Other fish remains indicate spring use, and pinyon hulls indicate fall use. Some of these remains could have been stored from previous years; the cattail pollen was not baked and is probably the least storable and, therefore, the best indicator of the season of use.

The remains in Hidden Cave suggest that its users ranged widely over specific parts of the western Great Basin. Most of the obsidian Gatecliff Series points were manufactured from source material from the Mono Lake area of California and from Majuba Mountain (north of the Carson Desert). Interestingly, of the obsidian Gatecliff Series points recovered from Kramer Cave, overlooking Winnemucca Lake (Hattori 1982), only one is attributed to a Mono Lake source. This may indicate that Hidden Cave and Kramer Cave, which were used at about the same time, were not included in the same territorial range. However, inhabitants of the Carson Desert must have had some contact with people to the west, or visited the area themselves, since some of the fish bones in the Hidden Cave coprolites are from Lahontan cutthroat trout and cui-ui, fish not native to the Carson River drainage.

While there is little evidence of residential occupation of the Carson Desert during the Devil's Gate Phase, there is evidence of substantial houses along the Sierran front at this time, e.g., at 5600 B.P. in Surprise Valley (O'Connell 1975), and at about 3500 B.P. at the Thompson Site, south of the city of Reno (Elston 1982). Furthermore, two probable house depressions were exposed at the Cocanour Site on the southern margin of the Humboldt Sink (Stanley, Page, and Shutler 1970); while the contents of the houses were meagerly informative, overall assemblage analysis suggested the site represents a single component occupation typologically ascribable to the Devil's Gate Phase.

At Rye Patch, an occupation dated to 3630-3250 B.P. contains evidence of a short term, probably spring/summer occupation, with little evidence of large mammal exploitation, suggestive of a short term residential use of the riverine ecotone (Rusco and Davis 1987). Leonard Rockshelter (Heizer 1951) may also indicate a system of high mobility, but its season of use and function are unknown, partly because the site never has been reported in its entirety. In sum, the archaeology of the Devil's Gate Phase in the western Basin suggests residential stability in the winter near the Sierran front, and high spring/summer residential mobility coupled with some resource exploitation (in the Carson Desert?) through logistical mobility.

Reveille Phase (2950 - 1450 B.P.)

During the Reveille Phase, the Carson Desert probably was used by entire residential groups, as there is, relative to the Devil's Gate Phase pattern, a decrease in the use of bifaces as cores and an increase in the use of expediently produced bipolar and casual percussion flake, and scavenged, tools (see Kelly 1985:243-245; Kelly 1987).

The archaeological deposits in Lovelock and Humboldt Caves shed light on the nature of the Reveille Phase occupation. About 2000 years ago (the mid-Reveille Phase), the cave sites were used to cache perishable gear such as duck decoys, fish hooks, and nets used to procure resources in the marshes of the Humboldt Sink. Each cave was used primarily for caches, as a "safe deposit box" (Heizer and Krieger 1956:5) rather than for habitation (Heizer and Napton 1970:43). The caches may indicate that the Humboldt and Carson sinks were used infrequently, or, at most, seasonally during the Reveille Phase, perhaps during times of resource stress (e.g., a failure of the fall pinyon nut crop, or an extensive bighorn sheep winter die-off) or, alternatively, during times of marsh resource 'blooms' (e.g., particularly large fall waterbird migrations). The former interpretation may be more likely since some marsh resources, such as waterbirds, cattail roots, and bulrush roots are, in general, less nutritionally and energetically useful than Great Basin terrestrial large mammal resources (see Simms 1984) and, according to optimal foraging theory, should have been used only when the encounter and acquisition rates for higher ranked resources, such as large game or pinyon nuts, were so low that the energetic returns for taking them were less advantageous than for taking marsh resources. This interpretation is supported by Thomas's interpretation of the seed-bearing coprolites at Lovelock and Hidden caves (Ambro 1967; Cowan 1967; Heizer 1969) as evidence of a 'second harvest' subsistence strategy (Thomas 1985:380-381), obviously a back-up subsistence technique. If the less useful marsh resources were being used primarily during times of resource stress, they probably were exploited through residential mobility to offset the high cost of transport by logistical parties (see Kelly 19835:175-180).

Elsewhere in the western Great Basin, there is some evidence of reduced residential mobility during the Reveille Phase. Shallow pithouses at Marble Bluff, near the south end of Pyramid Lake, date to the late Reveille Phase. The use of substantial structures continues along the Sierran front at Bordertown, the Karlo Site, Dangberg Hot Springs, and in the Truckee Meadows (Elston 1982); all of these are probably winter encampments. In contrast, a single structure at Trego Hot Springs, near the southern edge of the Black Rock Desert, contained floral and faunal evidence of a spring or early summer occupation (Davis and Elston 1972; Seck 1980).

Underdown/Yankee Blade Phases (1450 - 100 B.P.)

Use of the Carson Desert shifted after 1500 B.P., but it is unclear exactly when this shift occurred (Elston 1982:198; Kelly 1987); the 1980-81 survey data did not permit the Underdown Phase to be investigated independent of the Yankee Blade Phase (Kelly 1985:287). In general, there is evidence from the Carson Desert and elsewhere of a shift toward decreased residential mobility, with sedentism in some areas. For example, all six dated pithouses at 26Ch15 date to after 1500 B.P., although a burial dates to the Reveille Phase and a 'storage' pit to the Yankee Blade Phase (Livingston 1988). Site 26Pe67 (Cowan and Clewlow 1968), which contains at least 16 shallow structures, probably dates to the Underdown/Yankee Blade Phases, based on projectile point styles. In addition, pithouses at the recently excavated Vista Site, on the Truckee River east of Reno, date to the Underdown (Early Kings Beach) Phase (Zeier and Elston 1986). Long-distance, perhaps task-specific, logistical hunting may have increased as a function of decreased residential mobility, and is indicated by the presence of Yankee Blade Phase hunting sites in the Stillwater Range (Kelly 1985:299-301) and at Painted Cave, just east of the Stillwater Range (Bard, Busby, and Kobori 1978). Hunting related caches (26Wa197) at Pyramid Lake (Hester 1974; see also Tuohy 1974) and Eastgate Cave (Elsasser and Prince 1961; see also Janetski 1979) also suggest a change in hunting strategies, perhaps with greater use of small mammal/rodent trapping and long distance logistical hunting. The bow and arrow came into use at this time, and may reflect a shift in hunting strategies from communal kills to individual sit-and-wait or stalk tactics (Kelly 1987). Moreover, if site component density per unit of time can be accepted as a measure of population increase, then there is evidence of such an increase during the Underdown Phase, becoming greatest during the Yankee Blade Phase (Kelly 1985; Elston 1982).

Recent Developments

The existence of the Stillwater Marsh sites was not suspected when the 1980-81 survey was undertaken. The survey was conducted after a long drought, so that sites were observed only in large deflation basins; surface evidence of features or burials had been obliterated by wind erosion or covered by the alkaline crust which forms on the desert's surface. As indicated earlier, the marsh sites began to be revealed by flooding between 1981 and 1986.

Initial excavation at Stillwater Marsh focused on salvage recovery of human burials eroding from dunes (Tuohy et al. 1987). Burials usually are flexed and face east, with the head toward the north, though there is some variability in burial method. Those burial pits which contained grave goods indicate a predominant Underdown Phase occupation, but few of the burials contained such goods. Projectile points of the Reveille, and especially Underdown, Phases are most common, although points from the entire 5000 year sequence have been recovered.

Preliminary analysis of faunal remains collected from burial fill and from the surface has revealed individuals from 26 taxa, including waterbirds, fish (chubs), canids, mustelids, lagomorphs, amphibians, rodents, molluscs, and artiodactyls (Tuohy, Dansie, and Haldeman 1987). Coots, pelicans, and swans are the most common, and suggest a winter occupation. A buried section of sheep neck may be evidence of meat storage (Tuohy, Dansie, and Haldeman 1987). Carnivores appear to have been exploited for their skins alone, while the bighorn sheep remains bear evidence of having been butchered for meat. Many of the burials contained bird bones, with a bird humerus placed below the head in a number of cases; while this may be a function of the use of midden as burial fill, it will be impossible to ascertain until a general midden area is excavated.

In 1987, Kelly conducted excavations at two marsh sites, 26Ch1062 and 26Ch1052. Excavation was the more extensive at 26Ch1062; only three features and a non-feature midden area were tested on 26Ch1052. At 26Ch1062, two midden-filled house depressions (Features 4 and 7), were excavated in their entirety, one probable outside midden area was tested, and 11 pits outside the houses were tested. In addition, 2 possible hearths in the houses (one associated with a floor), 12 pits in Feature 7 and 11 in Feature 4, as well as 13 postholes in

Feature 7 and 11 in Feature 4, were excavated. The faunal assemblage consists primarily of waterbirds and fish, with small mammals/rodents a distant third; there are almost no large mammal remains that are not tool fragments. At the moment, site seasonality cannot be determined, although the presence of egg shell does indicate a spring/early summer occupation. Only one burial was encountered in excavation, but was not removed. Flotation samples can be expected to yield plant macrofossils.

Site 26Ch1062 probably dates to the Underdown Phase, based on projectile point styles and substantiated by two ^{14}C dates, 830±80 B.P. (Beta - 25041) and 1100±120 B.P. (Beta - 23853). In addition, a backhoe trench exposed a former marsh level, about one meter below the bottom of site, that contained a volcanic ash tentatively identified by Jonathan Davis (personal communication 1987) as one of the Mono ashes; the organic layer dates to 2940±70 B.P. (Beta - 24884). Keith Katzer (personal communication 1987) in the summer of 1987, located a similar stratigraphic unit lying below several other sites in the central marsh area, suggesting that those sites also may date to the Underdown Phase. In addition, site reconnaissance and mapping by the U.S. Fish and Wildlife Service recovered a high frequency of Rosegate projectile points.

The picture emerging at present is that the marsh use was predominant during the Underdown Phase. Caution must be taken in accepting this statement at face value, since it first must be substantiated by more accurate dating methods (e.g., ^{14}C). The hydrology of the marsh is complex; the Carson Desert is fed by two river systems that have changed course during floods, affecting the distribution of water on the valley, and the entire marsh is undergoing tectonic subsidence (cf. Chapter 4). A "sudden" appearance or disappearance of sites in the marsh could be indicative of large scale changes in the organization of prehistoric systems, but it also could be a function of changes in the location or productivity of the marsh. Still, it appears the archaeology of the Stillwater Marsh affords an opportunity to study the Rosegate occupation of the area. This is important not only in terms of filling gaps in the prehistoric sequence, but also because, as noted above and as discussed in more detail below, important shifts in aboriginal lifeways occurred after 1500 B.P. in the western Great Basin. The archaeology of the Stillwater Marsh may be a remarkably important, yet undeciphered "document" for Great Basin prehistory and for the study of hunter-gatherer society.

The Carson Desert in Theoretical Perspective

Several authors have recognized that major shifts in aboriginal lifeways occurred after 1500 B.P. The bow and arrow, for example, probably first came into use after 1500 B.P. (Elston 1986). Madsen (1986) suggests that evidence of intensive pinyon exploitation does not appear until after 2000 B.P., and in some places not until 1500 B.P. Elston (1982) notes an increase in plant processing equipment in western Great Basin sites after 1500 B.P., and Bettinger and Baumhoff (1982) see a shift toward the use of pinyon and grass seeds after 650 B.P. coupled with less use of large game. This is supported by a decrease in projectile point resharpening after 1500 B.P. (Kelly 1987) and by few associations between post-650 B.P. projectile points and piled stone hunting facilities (Pendleton and Thomas 1983). Post-1500 B.P. settlement systems in the western Great Basin may have been less mobile than earlier systems (Kelly 1985:302-303, 1986a, 1987; Elston 1982). However, evidence of increased sedentism in the form of shallow, semi-subterranean houses occurs elsewhere in the western Great Basin sometime after 3000 B.P. (e.g., at Marble Bluff near Pyramid Lake [Clarke 1978], and especially along the eastern Sierran slope [Elston 1986]). Intensive residential use of alpine regions of the Great Basin also occurs after 650 B.P., if not after 1500 B.P. (Thomas 1982; Bettinger, personal communication 1986). While it is clear that western Great Basin aboriginal lifeways were changing after 1500 B.P., we still do not know the pace or even the precise nature of the changes.

Of particular interest are the changing roles of pinyon, grass seeds, large terrestrial game (bighorn sheep and antelope), and marsh resources in aboriginal diets, and their relationship to changes in residential and logistical mobility strategies. Since the use of these resources was changing after about 1500 B.P. and since mobility also was decreasing by 650 B.P., if not by 1500 B.P., an understanding of the relationship between resource use and mobility will contribute to an understanding of the sedentization process.

For some time, anthropologists assumed that sedentism was the logical outcome of the exploitation of abundant food resources and was more desirable than a mobile lifeway (e.g., Beardsley 1956:134). However, more recent students have criticized this position, claiming that resource seasonality, rather than abundance, is the critical variable (Rafferty 1985:199), and that mobility provides hunter-gatherers with information on distant resources and helps maintain social ties among groups; both assist hunter-gatherers during periods of local resource fluctuations (see Binford 1980, 1983:201; Price and Brown 1985; Brown 1985; Rafferty 1985; Hitchcock

1982:255-256). Rather than being the "goal" of hunter-gatherers, sedentism is seen as an adaptation to a particular set of environmental (both social and physical) circumstances that requires that hunter-gatherers become sedentary. Various questions are relevant: What are those circumstances? What exactly is the process of sedentism? Is there more than one evolutionary pathway to sedentism?

Brown (1985:224) has suggested that "risk management ... is the mechanism that promotes the shift away from residential mobility", since most living systems respond not to average conditions but to the temporal and spatial variability in an environment (cf. Winterhalder 1980). Risk is generated by population growth, resource distribution and productivity, and yearly variability in the abundance and quality of food resources. Population growth encourages territorial packing, forcing hunter-gatherers to restrict themselves to smaller and smaller territories and to exploit a given locality more intensively (Cohen 1985). Seasonality can exacerbate this situation by requiring hunter-gatherers to exploit a restricted locality for current and future food needs (as stored resources). The perspective taken here focuses on the relative energetic (caloric) costs of hunting and collecting the various resources found in the Great Basin as well as yearly variability among those resources. Two models are discussed. The first focuses on (1) the effects of an increased need to store resources for winter use after 1500 B.P., (2) variability in, and therefore decreased dependability on, large terrestrial game, (3) population increase, and (4) the energetics of hunting large game versus collecting less energetically efficient, but more reliable, marsh resources. The second model examines the effects of the alleged Numic migration into the Great Basin.

Marsh-oriented Lifeway: Resource Model

Post-1500 B.P. changes in western Great Basin aboriginal lifeways may be related to ecological changes produced by a shift from spring/summer-dominant precipitation to a winter-dominant regime. This shift might have begun as early as 1500 B.P. (Davis 1982), although the paleoclimatic record from 1500 to 600 B.P. is confusing and contradictory. The shift to winter-dominant precipitation was associated first with a decrease in annual precipitation, but later, after 600 B.P., with increasing precipitation which was clearly winter-dominant. Analysis of modern climatic data suggests that a shift from summer to winter dominant precipitation is associated with an increase in yearly precipitation variability (Kelly 1986a). In brief, a shift to winter-dominant precipitation could have increased winter severity while decreasing annual precipitation predictability. An increase in winter severity could have increased the need for storable resources, such as pinyon and grass seeds. Moreover, increased variability in winter severity might have (1) decreased the reliability of winter hunting, since severe winters are the primary cause of long-distance migrations and herd die-offs of bighorn sheep and antelope (Kelly 1985:58-64; 1986a), and (2) increased variability in summer grass seed production, since 90% of grass production variability can be attributed to variability in winter precipitation (Sneva and Britton 1983). This could have had special consequences for inhabitants of the western Great Basin where pinyon, the primary stored winter resource elsewhere in the Basin, is not common. Moreover, the western region has the highest annual variability in precipitation of all Great Basin settings (Houghton 1969). Once precipitation became winter-dominant, grass seeds and large game might have become less reliable, increasing the risk associated with winter subsistence. The marsh resources of the Carson Desert might have been important in this regard.

Simms (1984) has evaluated harvesting and processing efficiency relative to a variety of Great Basin resources. His data indicate that the few marsh resources investigated are procured at a lower rate of efficiency than other Great Basin resources. Simms's data also indicate that a decrease in large game should result in the use of lower-ranked resources, including grass seeds, pinyon, and various marsh resources, since, according to optimal foraging theory, lower-ranked resources will be added to the diet as a function of decreases in higher ranked resources.

Marshes have a special property which could have made them attractive to hunter-gatherers occupying an uncertain environment who needed to store resources for the winter. Marshes have a complex trophic structure as well as a large base of primary production, and therefore contain a greater diversity of resources than do equal areas of Great Basin desert. Although marsh resources fluctuate in their abundance from year to year, often quite dramatically (Kelly 1985:81-87), their ecology is such that <u>some</u> food resource almost always will be available during any season of any year. Under climatic conditions which decreased the overall reliability of potential winter resources, marshes would have been high-cost, but relatively risk-free, resource zones.

Thus, post-1500 B.P. changes in aboriginal lifeways may have been adaptations to changes in food resource density and reliability - large game and grass seeds in particular - as well as to an increase in the need to store food resources for the winter. This situation may have been exacerbated after

650 B.P. by population increase, and might have required more intensive exploitation of marsh resources and increased use of 'storable' resources such as grass seeds and pinyon. Increased use of stored resources permits reduced residential mobility. Moreover, overall, or even periodic, decreases in large game density might have increased the search time needed to exploit certain resources and required reduced residential mobility and increased use of logistical mobility (Kelly 1983b, 1986b). While this model might account for post-1500 B.P. changes in lifeways, there is a competing explanation which can be tested in the Carson Desert.

Marsh-oriented Lifeway: The Numic Migration

Bettinger and Baumhoff (1982) attribute late prehistoric shifts in lifeways to the influx of Numic speakers, who, linguistic data suggest, migrated into the Great Basin 500 to 700 years ago. Bettinger and Baumhoff argue that the Numic peoples were equipped with an adaptive strategy which allowed them to out-compete the existing inhabitants. This adaptive strategy entailed reduced residential mobility, less use of large game, and greater use of seed resources. Assuming a division of labor in which women gather plant foods and men hunt, Bettinger and Baumhoff argue that pre-Numic peoples, who emphasized hunting, had an unbalanced sex ratio favoring males, while the Numic peoples, who relied heavily on plant-gathering, had a more balanced sex ratio. The pre-Numic peoples are seen as highly mobile, taking only the most energetically efficient resources (i.e., large game), while the Numic peoples are seen as having a less efficient, but more diversified and thus more stable, economy. Bettinger and Baumhoff suggest that the Numic adaptation was more successful than the pre-Numic one, with cultural and demographic factors preventing the pre-Numic peoples from shifting their lifeway. Post-1500 B.P. climatic changes might have been the selective factor which operated in favor of the Numic peoples, by favoring an adaptation involving intensive processing of a diversity of resources, including storable ones, and by favoring an adaptation which allowed people to survive resource fluctuations through resource switching and intensification, rather than through mobility, an expensive option and the only one available to hunter-gatherers focusing on large game. On the other hand, the behavioral adaptations which Bettinger and Baumhoff attribute to the Numic peoples may have been forming prior to the Numic expansion, and the Numic peoples may not have replaced other populations so much as they may have combined with them. Alternatively, it is possible that the glottochronological reconstruction is in error and that Numic peoples inhabited the Great Basin prior to 700 B.P.

Both the in situ and migration hypotheses explaining late prehistoric cultural change in the western Great Basin can be tested through excavation and analysis of the artifactual and human remains in the Stillwater Marsh sites. This is an important research issue as it calls into question the roles climate versus cultural historical factors play in conditioning temporal shifts in hunter-gatherer lifeways.

Significance

It is obvious the Stillwater Marsh can contribute valuable information on a poorly understood region of the Great Basin. Janetski (1986) has pointed out that an understanding of Great Basin marsh adaptations is hampered by a lack of knowledge of the archaeology of such regions. The archaeology of the Marsh also stands to contribute to an understanding of the Numic expansion, and to provide data needed to confirm or falsify existing hypotheses on hunter-gatherer adaptive strategies. A knowledge of the specific archaeological sequence in the Carson Desert will contribute especially to an understanding of the sedentization process, an important concern in anthropology. Ethnographic and archaeological data indicate that sociopolitical complexity occurs within the context of sedentization (e.g., Price and Brown 1985); a better understanding of the process will lead to a better understanding of the origins of sociopolitical complexity.

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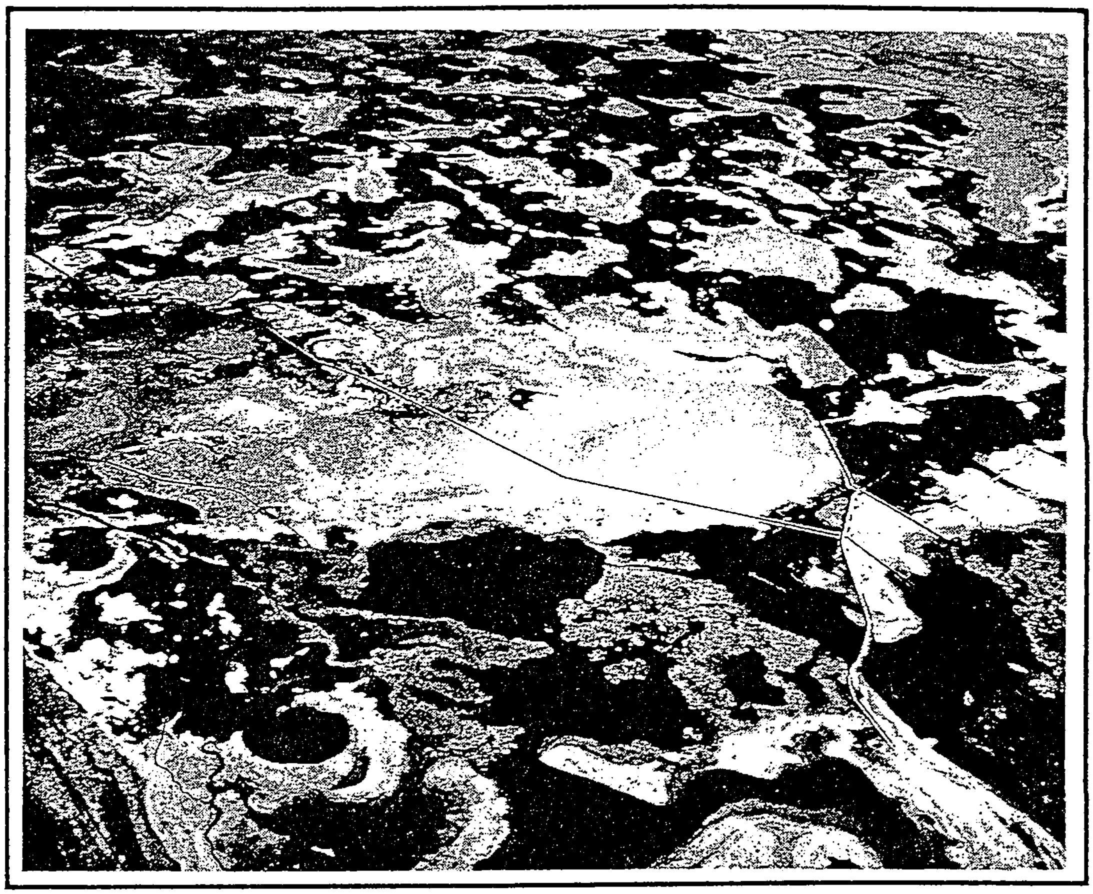

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